

VIRGINIA DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION
INSTRUCTIONAL & INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: Pavement Markings and Markers	NUMBER: IIM-TE-393 SUPERSEDES:
SPECIFIC SUBJECT: Pavement Marker Usage in VDOT Projects, Permit, and Maintenance Activities	DATE: November 1, 2020
APPROVAL: <div style="text-align: center;">/original signed by/ Raymond J. Khoury, P.E. State Traffic Engineer Richmond, VA 10/26/2020</div>	

1.0 PURPOSE AND NEED

This memorandum provides information and policies on the removal of cast iron snowplowable raised pavement markers (SRPMs) and the use and application of Plastic Inlaid Markers (PIMs) in VDOT construction, permit and maintenance activities. VDOT has discontinued use of SRPMs and transitioned to a PIM system wherever pavement markers are used.

The transition to PIMs began in August 2019 with a [memorandum](#) published by VDOT's State Construction Engineer (SCE). A [subsequent memorandum](#) from the SCE issued on December 12, 2019 (including the [companion Q&A memorandum](#) issued on January 10, 2020) addressed removal of existing cast iron SRPMs in current projects as of that date.

This IIM does not address:

- Maintenance of existing cast iron SRPMs unimpacted by other maintenance or construction activities,
- Temporary pavement markers,
- Nonplowable markers (such as those sometimes affixed to curbed islands and median noses),
- Details regarding the sequence of construction that are addressed in specifications/special provisions or are means/methods issues to be determined by the Contractor, or
- Reporting and tracking of the migration from cast iron SRPMs to PIMs.

2.0 BACKGROUND

2.1 Historical Background

For over 25 years, VDOT has used pavement markers to supplement many skip, gore, and center longitudinal pavement markings, for the following reasons:

- Pavement markers have been consistently demonstrated to be an effective method of ensuring the driver's ability to discern travel lane placement at night, particularly during inclement weather, with a good safety benefit/cost ratio.
- As per the national Crash Modification Factor Clearinghouse, properly sited markers can reduce crashes by up to 24% on undivided roads and up to 33% on limited access highways.
- Markers that supplement skip and gore lines on divided highways have red retroreflectors, which could aid in catching the attention of a wrong-way driver who has managed to enter onto the wrong side of a divided highway.
- Markers at gore areas reduce the risk of drivers entering the gore area and crashing into the Exit sign or running off the road.

Markers consist of two components: holders and retroreflectors. Until 2019, VDOT primarily used "H" shaped 5.5-pound cast iron SRPM holders that were epoxied into cuts in the pavement (see **Figure 1**). The holder secured the retroreflector slightly above the road surface and was designed to allow a snow plow to pass over it without damage.



Figure 1. Cast Iron SRPM

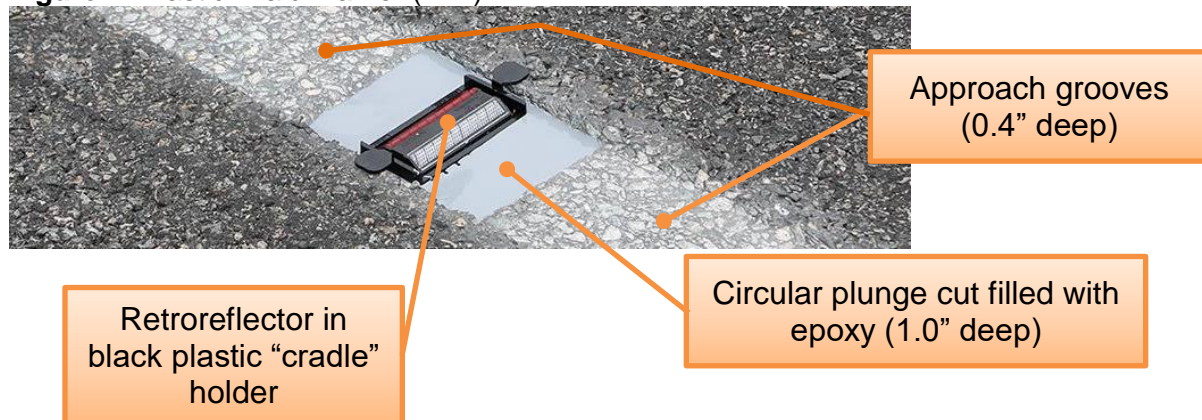
2.2 Plastic Inlaid Marker (PIM) Background

In March 2019, research on an alternative Plastic Inlaid Marker (PIM) product (also known as "Inlaid Pavement", "lens cradle", "slotted", or "recessed" markers) was completed at the National Test Product Evaluation Program (NTPEP) test deck for asphalt and concrete surfaces.

VDOT evaluated those results, as well as the experience in other states, and determined that the Plastic Inlaid Marker product provides equal or better benefits and durability when compared to cast iron SRPMs.

PIMs consist of a plastic holder (sometimes referred to as "cradle" or "lens cradle") which is epoxied into a recessed groove cut into the pavement (See **Figure 2**).

Figure 2. Plastic Inlaid Marker (PIM)



The holder secures the retroreflector just below the surface of the pavement. Unlike cast iron SRPMs, the PIMs retroreflector sits below the surface. Therefore, PIMs must be coupled with shallow approach grooves upstream and downstream of the retroreflector so that approaching vehicle headlights will reflect off the retroreflector from a sufficient advance distance. VDOT currently installs a single PIM in a 7-foot groove¹, based in part on feedback from other state DOTs that have more years of experience with PIMs.

PIMs shall be installed as per Standard Drawing PM-8.

3.0 EFFECTIVE DATES FOR PROJECTS, CONTRACTS, AND PERMITS

In accordance with the August 5, 2019 State Construction Engineer memorandum, cast iron SRPMs have been disallowed for all contracts advertised after January 1, 2020.

Effective dates of this IIM for different project delivery methods are summarized in **Table 1**.

¹ Standard Drawing PM-8 allows the groove to be shortened on sharp curves, if approved by the Engineer during construction.

Table 1 – IIM-TE-393 Effective Date for VDOT PIM Installation Activities

IIM-TE-393 Applicability to VDOT PIM Installation Activities		
	State Construction Engineer Memos Applicable	IIM-TE-393 Applicable
Paving Schedules	<ul style="list-style-type: none"> • 2020 Paving Schedules • Districts were previously directed to remove existing cast iron SRPMs as a part of all 2020 paving schedules, including Latex Modified/Slurry Seal/Surface Treatment (LM/SS/ST) schedules. 	<ul style="list-style-type: none"> • 2021 and future Paving Schedules • Existing cast iron SRPMs shall be removed as a part of all paving schedule contracts, including LM/SS/ST contracts.
Construction Contracts (Design-bid- build, Design- build, P3) (Non-Paving Schedule)	<ul style="list-style-type: none"> • All projects advertised on or before October 31, 2020. In addition, for contracts with cast iron SRPMs within the limits of long-term or permanent lane shifts, District Construction Engineers should modify the contracts to incorporate SRPM removal where required by Section 5.0 of this IIM, to the extent feasible and practical. • All projects advertised between November 1, 2020 and June 30, 2021. In addition, Section 5.0 of this IIM is effective. 	<ul style="list-style-type: none"> • All projects advertised on or after July 1, 2021
Land Use Permits	<ul style="list-style-type: none"> • Districts were previously directed to end use of cast iron SRPMs in Land Use Permit activities. • All plans submitted prior to November 1, 2020, District Land Use Engineers should work with permittees or developers to apply this IIM to the extent feasible and practical, if mutually agreed to. 	<ul style="list-style-type: none"> • All final land use permit plans submitted on or after November 1, 2020.
Maintenance Activities	<ul style="list-style-type: none"> • Work performed before November 1, 2020 	<ul style="list-style-type: none"> • Work performed on or after November 1, 2020

4.0 USAGE AND PLACEMENT CRITERIA FOR PLASTIC INLAID MARKERS

For each project that could potentially require the use of PIMs, designers are expected to follow a three-step decision-making process:

- 1) Should markers be provided? (Section 4.1)
- 2) If so, then how should they be spaced? (Section 4.2)
- 3) What additional considerations are necessary given the surface type? (Sections 4.3 – 4.5)

4.1 Marker Usage Criteria

Designers (or, for paving schedule contracts, those responsible for developing traffic pay item quantities) should determine whether to specify markers for the road segment under design based on the marker usage criteria outlined in the Virginia Supplement to the MUTCD (Section 3B.11) and the following:

- PIMs are not recommended for roadways with ADTs below the “should use” and “may use” thresholds listed in the Virginia Supplement to MUTCD (Tables 3B-V4 and 3B-V5 respectively, in the 2011 VA Supplement Revision #1), unless supported by an engineering study. The presence of existing cast iron SRPMs on the road does not in and of itself justify installation of PIMs on the replacement contract.
- See Section 4.5 below for criteria regarding PIMs in bridge decks.
- With rare exceptions, markers should never be used to supplement edge lines.

All references to SRPMs or RPMs in the Virginia Supplement to the MUTCD shall be considered to apply equally to PIMs.

4.2 Marker Spacing Criteria

When identified for use, determine the marker spacing criteria as outlined in the Virginia Supplement to the MUTCD (VA Supplement) (Sections 3B.11-3B.13) and the VDOT Road & Bridge Standards (PM-8).

PIMs shall not be spaced more closely than as outlined in the VA Supplement or Standard Drawings, even if the existing cast iron SRPMs are more closely spaced, unless supported by an engineering study.

PIMs shall not be “doubled up” on both sides of the double yellow line or one-way passing zone line, except when PIMs are installed in existing pavement and the existing pavement joint is between the double yellow line.

4.3 Concrete Roads

When identified for use, PIMs may be installed in existing or new concrete pavements. Placement in existing concrete pavements (more than one year old) requires concurrence of the District Materials Engineer or their designee.

4.4 Asphalt Roads

When identified for use, PIMs may be installed in new asphalt pavements as follows:

- PIMs may be installed in conjunction with either new Plant Mix mill and fill/reconstruction asphalt, or “Thin mix” paving schedule projects such as Latex Modified Emulsion Treatment/LM or Thin Mix Asphalt Concrete Overlay/THMACO).
- An emulsion (aka “fog sealing”) may be used to seal the PIM grooves where required by the District Materials Engineer.
- **Special care must be taken when planning a project involving a THMACO overlay atop an existing concrete road to ensure that the PIMs will not be installed directly atop the existing concrete joints.** The lateral location of the joint needs to be known in advance, otherwise once the THMACO is installed the joint is covered up and the pavement marking contractor may be unaware of its exact location. The “Inlaid Pavement Marker (concrete)”

pay item shall be used in such circumstances since a portion of the PIM depth will be cut into existing concrete.

PIMs may be installed in existing asphalt pavements if approved by the District Maintenance Engineer or designee.

4.5 Bridge Decks

When identified for use, PIMs may be installed on new bridge decks only when all of the following criteria are met:

- Marker use is required (a shall condition) by the Virginia Supplement to the MUTCD for the facility type and applicable conditions;
- The bridge deck is 200 feet or greater in length; and
- The road has a functional classification of Interstate, freeway, principal arterial, or minor arterial².

PIMs shall not be installed in existing bridge decks, unless they have an asphalt overlay thicker than 1.0 inches.

PIMs shall be sealed using a deck sealant for the grooves, using a material recommended by the District Bridge Engineer or designee.

5.0 EXISTING CAST IRON SRPMs WITHIN LIMITS OF TRAFFIC PATTERN CHANGES

When there are changes to traffic patterns on roads with existing cast iron SRPMs (either a permanent change, or a shift associated with a long-term work zone expected to be in place at least 3 months):

1. For asphalt roadways where the existing cast iron SRPMs will be:
 - a. Partially or fully within the shifted travel lanes: **the SRPMs shall be removed and the resultant voids patched** as per specifications prior to implementing the traffic shift.
 - b. Completely outside the travel lanes: **the retroreflectors shall be removed** but it is not necessary to remove the cast iron holders.
2. For concrete roadways or bridge decks where the cast iron SRPMs lie within the limits of a long-term or permanent lane shift, then the District shall consider on case by case basis whether to require removal of the cast iron SRPMs prior to initiation of the lane shift. If SRPM housings are left in place, then the retroreflectors shall be removed.
3. Temporary markers shall be used as per the Virginia Work Area Protection Manual (VWAPM) during traffic pattern changes.

6.0 MAINTENANCE ACTIVITIES FOR SRPMs AND PIMs

New cast iron SRPMs shall not be installed in maintenance contracts, however if the cast iron holder is in good condition, then it is acceptable to replace the retroreflector without removing the cast iron holder.

² Corresponding with Structure & Bridge Division policy on use of stainless steel rebar in new bridge decks.

For spot location maintenance, a PIM may be used to replace an existing cast iron SRPM without evaluation per the above PIM application process. PIMs must be offset at least 2 feet from the edge of the void left by the removed cast iron SRPM.

For maintenance activities involving a larger scale replacement (e.g. replace cast iron SRPMs along a one mile section of roadway), PIMs shall be applied per the above PIM application process.

As with previous VDOT practice regarding SRPMs, PIM retroreflectors should be replaced on a cyclical basis. It is not necessary to replace the holder when replacing PIM retroreflectors.

7.0 REFERENCES

- VDOT [Road & Bridge Specifications](#)
- VDOT [Road & Bridge Standards](#)
- [NCHRP Report 518](#), *Safety Evaluation of Raised Pavement Markers* (2004)
- [Evaluation of Alternatives to Provide Wet-Night Delineation](#), University of Kentucky (2016)
- FHWA-2018-NJ-04, [Evaluation of Raised Pavement Markers](#), NJDOT (2018)
- [Virginia Supplement to the MUTCD](#)
- [Virginia Work Area Protection Manual](#)
- Construction Division Memorandum (Aug 2019) - Plastic Inlaid Markers
www.virginiadot.org/business/resources/const/Constr-Memo-PlasticInlaidMarkers.pdf
- Construction Division Memorandum (Dec 2019) - Removal of Raised Pavement Markers
www.virginiadot.org/business/resources/const/Announce-RemovalRaisedPavementMarkers.pdf and accompanying Responses to Questions:
www.virginiadot.org/business/resources/const/Announce-RPM-RemovalQuestionResponses.pdf